**REMARKS**

Applicant respectfully requests reconsideration and allowance of all pending claims.

**I. Status of Pending Claims**

Claims 1-102 remain pending in the present application. Claims 103-107 are new.

Claims 1-3, 6, 59, 60, 62, 67, 68, and 72 have been amended. Support for the amendments to the claims with regard to the additional unmelted polycrystalline silicon can be found in the specification at, for example, paragraph 0041-0042.

Support for new claims 103-107 can be found in the specification at, for example, paragraph 0058.

**II. Claim Rejections under 35 U.S.C. 103(a)**

Reconsideration is requested of the rejection of claims 1-102 as being obvious over Holder (U.S. 5,588,993) in view of Kamio et al. (U.S. 5,087,429).

**II.A. There Is No Motivation to Combine Reference Teachings.**

Claim 1 is amended above to underscore that the feeding in applicant's invention is "feeding additional **unmelted** polycrystalline silicon into the rotating crucible by intermittently delivering the additional **unmelted** polycrystalline silicon...."

The Holder reference teaches feeding unmelted polysilicon continuously into a melt in order to prepare a melt. The Holder process involves forming the complete melt in this manner, and then initiating the pulling of the crystal. During the pulling, the level in the melt naturally decreases until the melt is depleted and the crystal is completed. In other words, the pulling of the crystal essentially empties the crucible. In

contrast, the Kamio et al. process involves continuous crystal pulling and simultaneous polysilicon replenishment to maintain a constant liquid level in the melt. The purpose of maintaining a constant liquid level is to yield a single crystal having dopant and oxygen concentrations which are substantially constant in the pull direction.

Inasmuch as Kamio et al. teach intermittent feeding as a way to achieve a constant liquid level in the melt in a simultaneous pulling and replenishing operation, it provides no motivation to employ intermittent feeding in the fundamentally different process involving creating a melt, pulling the crystal, and emptying the crucible without replenishing. The lesson from Kamio et al. about intermittent feeding is exclusively that it is valuable in replenishment to maintain constant liquid levels. Their intermittent feeding is specifically germane to replenishment and maintaining a constant liquid level. One skilled in the art attempting to improve a process like Holder's which does not maintain constant liquid levels by replenishment would not see any reason to employ Kamio et al.'s intermittent feeding. In fact, one skilled in the art working with a continually depleting melt such as Holder's is concerned with creating a melt which is to be depleted. He is not concerned with creating a melt and then maintaining a constant liquid level therein. Accordingly, there is no motivation to combine this aspect of the references in view of the inapposite fundamental nature of the operations: forming a melt to be depleted (Holder) versus maintaining a melt to be continually replenished and kept at a constant liquid level.

While modifying Holder with Kamio et al.'s intermittent feeding is not motivated for the foregoing reasons, applicant requests reconsideration of the assertion that the references may be combined because "The different results desired by Holder and Kamio are not because of the type of flow, intermittent or

continuous." Kamio et al.'s intermittent feeding is *expressly* and *specifically* germane to maintaining a constant liquid level in a process involving maintaining a melt to be continually replenished and kept at a constant liquid level:

> As an effective means of overcoming these deficiencies, there have been known methods of continuously or intermittently feeding a silicon starting material so as to maintain constant the liquid level of the molten material. Included among the methods of pulling a silicon single crystal while continuously or intermittently feeding the silicon starting material in such a manner are the inventions disclosed for example in Japanese Laid-Open Patents No. 56-84397 and No. 56-164097. Kamio et al., Col. 1, lns. 55 ff.

The Office's rationale of bifurcating Kamio et al.'s intermittent aspect from their "maintaining a constant liquid level" renders the teaching for intermittent feeding wholly devoid of any purpose. Accordingly, it ignores the mandate to consider the prior art teachings as a whole. It constitutes improper picking and choosing using applicant's claims as a guide.

And while modifying Holder with Kamio et al.'s intermittent feeding is not motivated for the above reasons, applicant also requests reconsideration of the assertion that the combination is motivated because "feed rate is a result effective variable (col. 5, ln. 30-45); therefore using the feed tube of Kamio et al. would improve feed rate control." Office Action on Page 7. Feed rate and intermittent feed method are independent parameters. Feed rate pertains to the amount of polysilicon fed to the crucible as a function of time, for example, 6 kg/hour. Intermittent feeding pertains to a method of feeding in which a discrete amount of polysilicon is added at specified intervals, for example 1 kg is added every 10 minutes. Both intermittent and continuous feed methods can be used *to achieve the same feed*

*rate*. That is a feed rate of 6 kg/hour and intermittent feeding of 1 kg every 10 minutes will result in the addition of 6 kg of polysilicon into the crucible after 1 hour. However, the feed rate of 6 kg/hour does not indicate anything with respect to the method of achieving that feed rate, either continuously or intermittently. Holder achieves his desired result by selecting a particular feed rate. But neither reference recognizes any particular result can be effected by selecting intermittent rather than continuous feeding:

> A particular parameter must first be recognized as a result-effective variable, i.e., ***a variable which achieves a recognized result***, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. MPEP 2144.05 Part. II. B.

Specifically, Holder does not refer to intermittent feeding at all. And Kamio et al. simply group intermittent in with continuous feeding without recognizing any specific difference in result effected by the selection. Since Kamio et al.'s desired result --- constant liquid level --- is achieved with either method, the selection of method neither **e**ffects not **a**ffects any particular result. Accordingly, any suggestion by Holder that feed rate is result effective is insufficient to motivate one to import Kamio et al.'s intermittent technique into Holder's process.

As discussed in more detail in applicant's specification and below, applicant has discovered that intermittent feeding in the context of creating a melt (as opposed to replenishing to maintain constant levels) can effect the result of completing the melt faster. But, as noted above, this result effectiveness was recognized by neither Holder nor Kamio et al. Applicant appreciates that *any* reasonable motivation in the references can be relied on by the Office for a combination -- the motivation need not be the same as applicant's motivation. But here any

such motivation is wholly lacking in Holder and Kamio et al. as discussed above.

**II.B. The Combination of References fails to Teach or Suggest all of the Claim Limitations.**

Applicant's claim 1 is further patentable because the combination of references fails to teach or suggest every claim 1 limitation. Applicant's claim 1 has been amended to clarify that the feeding is "feeding additional **unmelted** polycrystalline silicon into the rotating crucible by intermittently delivering the additional **unmelted** polycrystalline silicon..." This amendment underscores an additional distinction between the feeding method disclosed by the combination of Holder and Kamio et al. Specifically, the combination of references does not disclose "feeding additional unmelted polycrystalline silicon…by intermittently delivering…"

Holder does not teach intermittent feeding of unmelted polycrystalline silicon, as conceded by the Office on Page 2 of the Office Action dated July 26, 2005. The Kamio et al. reference fails to correct this deficiency because it discloses intermittent feeding of ***melted*** silicon. The Kamio et al. reference is cited by the Office as disclosing intermittent feeding of silicon, in Cols. 1 and 2 of Kamio et al. In fact, Kamio et al. refer to the Japanese Laid-Open Patent No. 56-164097 as disclosing intermittent feeding. The disclosure of this Laid-Open patent is further detailed in Col. 2, lines 3-11, where it is stated that the

> …single crystal pull apparatus equipped with a ***molten*** material feeder whereby…a powdered sample is temporarily stored ***and melted*** in the forward end of the powdered feed tube thereby intermittently supplying the molted material into a crucible….

Accordingly, neither Holder nor Kamio et al. disclose "feeding additional ***unmelted*** polycrystalline silicon…by intermittently delivering…" as required by applicant's claim 1.

The foregoing literal distinctions between the respective processes are not simply semantic. Rather, they are germane to the fundamental contrasting goals achieved by the respective processes:

> applicant's intermittent feeding directly onto the melt to "decrease the amount of time required to prepare a fully molten silicon melt compared to a continuous feeding method" Applicant's specification; paragraph 28.

*versus*

> Kamio et al.'s (more correctly Laid-Open Patent No. 56-164097) intermittent feeding of molten silicon "…so as to maintain constant the liquid level of the molten material." Kamio et al., Col. 1, lines 55-63.

Applicant also requests reconsideration of the assertion that, under *Ex parte Novak*, modifying Holder by importing Kamio et al.'s intermittent feeding would have been obvious. The *Novak* case has nothing to do with intermittent versus continuous feeding. In *Novak* the Board found that Sivetz's teaching to steam-strip to remove volatiles from coffee would motivate one to modify the Clark process by using steam-stripping to achieve the same result --- remove volatiles. If anything, *Novak*, underscores the need to find motivation for the proposed modification in the references themselves, rather than looking to applicant's claims for a reason to modify the process of the primary reference.

Moreover, in citing *Novak*, the Office has improperly attempted to shift the burden of proving non-obviousness to the applicant. The burden is on the PTO to establish *prima facie* obviousness. The burden is not on the applicant to establish patentability by virtue of non-extension of a presumption that,

e.g., intermittency does not establish patentability. There are multiple Federal Circuit cases which hold obviousness must be evaluated per the *Graham* factors and it is error to by-pass this analysis by applying negative maxims of "invention," whether that be "repetition of known steps," "synergism," "mere substitution of material," "reversal of parts," "no flash of creative genius," etc. The Federal Circuit has also ruled that evaluation of obviousness cannot isolate and focus on the "difference" from the prior art as the invention, but must determine obviousness of the subject matter as a whole, *Jones v. Hardy*, 220 USPQ 1021 (1984), *Gillette v. S.C. Johnson*, 16 USPQ2d 1923 (1990), and against the entire background of the art.

Moreover, the advantages afforded by intermittency are explained in applicant's specification (paragraph [0046]):

> Experimental results to date suggest that the intermittent feeding process can significantly shorten the feed time compared to a continuous feed process by depositing polycrystalline silicon on the entire exposed unmelted polycrystalline silicon prior to redepositing granular polycrystalline on any wedge.

In view of the above, applicant's claim 1 is patentable, and applicant respectfully requests withdrawal of the rejection.

**II.C. The Remaining Claims are Patentable.**

The remaining claims 2-102 either require or depend from a claim which requires feeding additional unmelted polycrystalline silicon into the rotating crucible by intermittently delivering the additional unmelted polycrystalline silicon. These claims are patentable over the cited combination for the same reasons as stated above in connection with claim 1, and by virtue of the additional requirements therein. Specifically, there is no motivation to combine the references to achieve the invention defined by the claims, and the combination of Holder and Kamio et

al. fails to teach or suggest the requirement of feeding additional unmelted polycrystalline silicon. Accordingly, applicant requests withdrawal of the rejections.

For example, claim 68, and its dependent claims, 69-96, all require feeding additional unmelted polycrystalline silicon intermittently and "…forming a depleted molten silicon charge in the rotating crucible from which the single crystal silicon ingot is grown…" There is no motivation to combine the references to achieve the process defined by claims 68-96 because the references are directed to fundamentally different processes for forming a silicon melt. The Kamio et al. process teaches simultaneous pulling and replenishing with molten silicon, so that it is desirable to "maintain constant the liquid level of the molten material." The Holder process involves completing a melt, removing the feed pipe, then pulling a crystal; so there is no simultaneous pulling and replenishing. Because the Kamio et al. reference refers to intermittent feeding only as a way in which others had achieved a) constant liquid levels, in b) a simultaneous pulling and replenishing operation, there is no motivation to modify the Holder process by incorporating this intermittent feature. Holder's process does *not* employ constant liquid levels, *nor* does it involve simultaneous pulling and replenishing. With this motivation lacking, the MPEP emphasizes that there is no *prima facie* case of obviousness:

> First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. MPEP 2143, first paragraph.

**III. New Claims 103-107**

New claims 103-107 each depend from a claim which requires feeding additional unmelted polycrystalline silicon intermittently. Accordingly, applicant respectfully submits that the new claims are patentable for the reasons stated above in

connection with claims 1 and 68. Specifically, there is no motivation to combine the reference teachings to achieve the combination of feeding additional unmelted polycrystalline silicon intermittently, pulling an ingot, and leaving a depleted molten silicon charge because the references are directed to fundamentally different processes, and the combination of references fails to teach feeding additional unmelted polycrystalline silicon intermittently.

**IV. Miscellaneous**

The Office states on page 6 of the Office action that applicant's previous remarks with respect to Nagai et al. were persuasive and the rejection of claims over that reference have been withdrawn. And the new rejection as characterized on page 2 of the Office action is over in Holder view of Kamio et al. However, there is a reference to Nagai et al. on page 3 and 6 of the Office action. This appears to be a clerical error. If the Office has intended to reject claims 4-5 and 53-58 over Nagai et al., please advise the undersigned. The reference to Nagai et al. on page 4 is only for purposes of noting the state of the art.

**Conclusion**

In view of the foregoing, applicant respectfully requests allowance of claims 1-107.

* A check and fee transmittal in the amount of $1160.00 are enclosed in payment of the Request for Continued Examination fee, additional claims fee, and one-month extension of time fee. The Commissioner is also authorized to charge any fee deficiency or credit any overpayment to Deposit Account No. 19-1345.

Respectfully submitted,

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